Relation Between b_{sp} and PM

Presented by:
Willard Richards
Siana Alcorn
Sonoma Technology, Inc.
Petaluma, CA

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Relation Between Ambient and Measured b_{sp}

- Sample airflow was heated only when the RH in the scattering chamber exceeded 65% and the heating kept the RH from exceeding about 72%.
- Heater successfully protected the nephelometer from fogs.

Relation Between Ambient and Measured b_{sp}

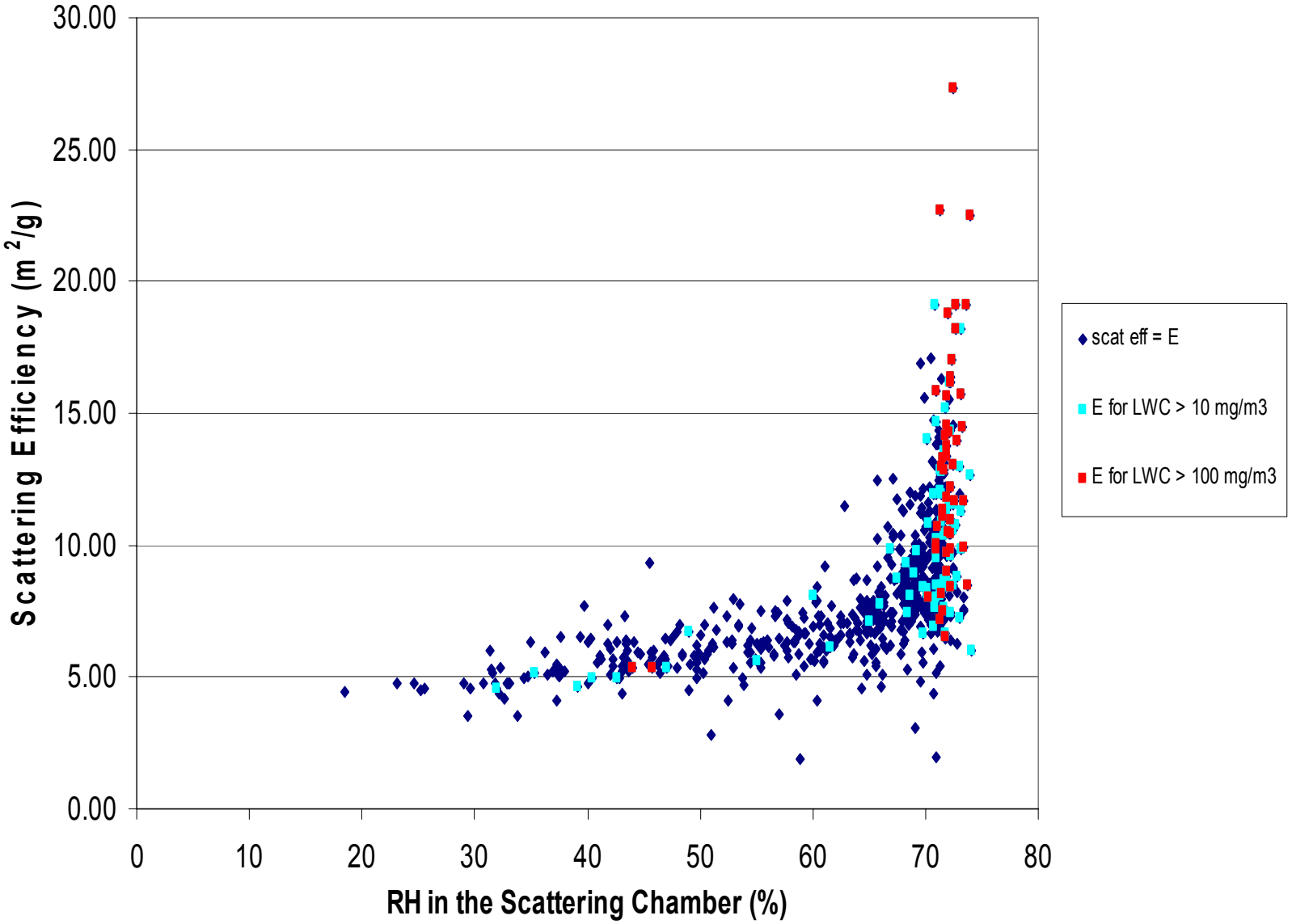
- No size selective inlet.
- $PM_{2.5}$ sampling efficiency believed to be good, but coarse particle sampling efficiency not characterized.

During Winter in SJV

- Dust is suppressed, so the fine particle tail of the coarse particles makes a smaller contribution to the measured b_{sp}.
- When the RH in the scattering chamber is less than 65%, the light scattering efficiency from regression against $PM_{2.5}$ is typically 5 to 6 m^2/g.

Effect of RH

- The following slide shows the light scattering efficiency as a function of RH in the scattering chamber calculated from the measured b_{sp} and BAM $PM_{2.5}$ at Angiola.


30.00
25.00
20.00
15.00
10.00
5.00
0.00
Scattering Efficiency (m 2/g)
0
10
20
30
40
50
60
70
80
RH in the Scattering Chamber (%)
scat eff = E
E for LWC > 10 mg/m3
E for LWC > 100 mg/m3

Remedy?

- Decreasing the RH threshold for heating has been mentioned.
- Perhaps that would only move the range of variable results to lower RH, which would affect more of the data.
- I favor increasing the residence time between drying and measurement and stronger heating.

During Summer or in Desert

- $PM_{2.5}$ can be attributed to “smog” and the $PM_{2.5}$ tail of the “dust” particles.
- The scattering efficiency of the “dust” $PM_{2.5}$ is roughly 1 m^2/g, compared to 5 to 6 m^2/g for the “smog” $PM_{2.5}$.
- Scatter diagrams of b_{sp} versus $PM_{2.5}$ look as if produced by a shotgun.

During Summer or in Desert

- $PM_{2.5}$ concentrations do not exceed standards in the SJV during the summer, so the ability to predict $PM_{2.5}$ from b_{sp} data is not as crucial as in the winter.
- All field studies have found that b_{sp} is not well correlated with coarse particle concentrations.

Regression in Summer or Desert

- $b_{sp} = A + E_{2.5}\,PM_{2.5} + E_C\,PM_C$
- This equation assumes A, $E_{2.5}$, and E_C are constant.
- In fact, $E_{2.5}$ decreases with increasing $PM_C / PM_{2.5}$.
- The regression analysis accounts for this by assigning E_C a negative value.

Regression Analyses

- b_{sp} = [Esf + (Esc – Edc)Fsc]Mf
  [(Edf – Esf)Fdf + Edc]Mc

  Fsc Fraction of “smog” in coarse size
  Fdf Fraction of “dust” in fine size
  E Light scattering efficiencies
  s “smog” d “dust” f fine c coarse
- White et al. (1994) Atmos. Env. **28**, 909

Recommendations

- It is recommended that the b_{sp} data be used for PM model validation.
- It should be possible to calculate b_{sp} from the simulated PM data.
- When the RH in the scattering chamber is greater than 65%, the calculated b_{sp} should be equal to or less than the measured b_{sp}.